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WHAT IS CLAIMED IS:

1. A photo-sensing device package comprising:

(a) an assembly portion including:

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i. a substrate formed of a material substantially transparent to light within a predetermined range of wavelengths;

ii. at least a first metal layer formed on said substrate about a front surface region thereof; and,

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iii. at least one passivation layer formed to extend over said first metal layer, said passivation layer being patterned to define a plurality of first and second access openings to respectively describe on said first metal layer a plurality of first and second solder bump pads, each of said first solder bump pads being interconnected to at least one of said second solder bump pads;

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(b) a sensing portion including at least one photo-sensing die, said photo-sensing die having formed at a forward surface thereof at least one photo-sensing area for photo-electronically transducing light within said predetermined range of wavelengths, said photo-sensing area opposing said front surface region of said

5 assembly portion substrate, said photo-sensing die having  
formed thereon a plurality of solder bump pads electrically  
coupled to said photo-sensing area; and,  
(c) a plurality of first solder joints joining said sensing and  
assembly portions, each of said first solder joints extending  
10 between one said solder bump pad of said sensing portion and  
one said first solder bump pad of said assembly portion.

2. The photo-sensing device package as recited in Claim 1 further  
15 comprising a plurality of second solder joints each extending from said  
second solder bump pad through one said second access opening of said  
assembly portion for mounting to an external circuit.

5           3. The photo-sensing device package as recited in Claim 2 wherein said  
second solder joints each extend from said second bump pad transversely  
beyond said photo-sensing die of said sensing portion joined thereto.

10           4. The photo-sensing device package as recited in Claim 1 wherein said  
assembly portion includes at least one dust-seal layer formed on said substrate  
about said front surface region thereof, said dust seal layer extending  
transversely between said substrate and said photo-sensing die to enclose a  
sealed compartment therebetween.

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5. The photo-sensing device package as recited in Claim 4 wherein said  
dust-seal layer is formed of a polymer material.

5           6. The photo-sensing device package as recited in Claim 1 wherein said  
substrate is formed of a borosilicate glass material.

          7. The photo-sensing device package as recited in Claim 6 wherein said  
10       substrate is formed with a thickness within the approximate range of 250 to  
800 micrometers.

          8. The photo-sensing device package as recited in Claim 4 wherein said  
15       substrate is formed of a borosilicate glass material having a thickness within  
the approximate range of 250 to 800 micrometers.

5           9. The photo-sensing device package as recited in Claim 1 wherein said  
photo-sensing area of said photo-sensing die is disposed in optical alignment  
with said front surface region of said substrate for receiving light passed  
therethrough.

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          10. The photo-sensing device package as recited in Claim 1 wherein said  
assembly portion includes a second metal layer formed at least partially on  
said passivation layer, said second metal layer being patterned to extend at  
least partially over said first and second access openings to contact said first  
15       and second solder bump pads.

          11. The photo-sensing device package as recited in Claim 1 wherein said  
substrate includes a rear surface on a side thereof opposing said front surface,  
20       said substrate having a thin film coating formed on at least one of said front  
and rear surfaces for altering the transmissivity therethrough of light within  
said predetermined range of wavelengths.

5           12. The photo-sensing device package as recited in Claim 4 wherein said  
substrate includes a rear surface on a side thereof opposing said front surface,  
said substrate having a thin film coating formed on at least one of said front  
and rear surfaces for altering the transmissivity therethrough of light within  
said predetermined range of wavelengths.

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          13. The photo-sensing device package as recited in Claim 1 wherein each  
of said solder bump pads of said sensing portion and said first and second  
solder bump pads of said assembly portion is formed with a multi-layered  
15 structure including at least an adhesion layer, a diffusion barrier layer, and a  
solder wettable layer.

5           14. A method of packaging a photo-sensing device comprising the steps  
of:

- 10           (d)   establishing at least one photo-sensing die having at least  
integrated one photo-sensing area defined at a forward surface  
thereof for photo-electronically transducing light within a  
predetermined range of wavelengths;
- (e)   forming on said photo-sensing die a plurality of first solder  
bumps electrically coupled to said photo-sensing area;
- (f)   establishing at least one unit substrate formed of a material  
15           substantially transparent to light within said predetermined  
range of wavelengths;
- (g)   forming at least one metal layer on said unit substrate about a  
front surface region thereof,
- (h)   configuring said metal layer to define a plurality of first and  
20           second solder bump pads and a plurality of interconnection lines  
each extending between at least one first solder bump pad and at  
least one said second solder bump pad;
- (i)   forming at least one passivation layer to extend over said metal  
layer;

- 5 (j) configuring said passivation layer to define a plurality of first and second access openings aligned respectively with said first and second solder bump pads;
- (k) placing said photo-sensing die in inverted manner over said unit substrate, said first solder bumps each engaging one said first access opening of said passivation layer to contact one said first solder bump pad, said photo-sensing area of said photo-sensing die being thereby guided into alignment with said front surface region of said unit substrate; and,
- 10 (l) heating said first solder bumps to a characteristic reflow temperature thereof for attachment to said first solder bump pads of said unit substrate.
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15. The method of packaging a photo-sensing device as recited in Claim 20 14 further comprising the step of attaching a plurality of second solder bumps respectively to said second solder bump pads through said second access openings.



5           16. The method of packaging a photo-sensing device as recited in Claim  
14 further comprising after step (g) the step of forming a dust-seal layer about  
said front surface region of said unit substrate.

10           17. The method of packaging a photo-sensing device as recited in Claim  
15 further comprising the steps of pre-forming said first and second solder  
bumps with solder ball configurations, said second solder bumps being greater  
in a diametric dimension than said first solder bumps.

15           18. The method of packaging a photo-sensing device as recited in Claim  
14 further comprising the step of forming an upper metal layer at least  
partially on said passivation layer, said upper metal layer being configured to  
extend at least partially over said first and second access openings to contact  
20       said first and second solder bump pads.

5           19. The method of packaging a photo-sensing device as recited in Claim  
14 wherein a plurality of said unit substrates are integrally defined on a  
substrate, said substrate being diced after step (j) for separation of said unit  
substrates one from the other.

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20. The method of packaging a photo-sensing device as recited in Claim  
14 wherein a plurality of said photo-sensing dice are integrally defined on a  
wafer, said wafer being diced before step (i) for separation of said photo-  
sensing dice one from the other.

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21. The method of packaging a photo-sensing device as recited in Claim  
20 wherein a pick-and-flip-and-place operation is sequentially executed to  
place said photo-sensing dice respectively over corresponding ones of said  
20 unit substrates.

5           22. A method of packaging a photo-sensing semiconductor device  
comprising the steps of:

- 10           (m)   establishing at least one semiconductor die having at least  
integrated one photo-sensing area defined at a forward surface  
thereof for photo-electronically transducing light within a  
predetermined range of wavelengths;
- (n)   forming on said semiconductor die a plurality of solder bump  
pads to be electrically coupled to said photo-sensing area;
- (o)   attaching a plurality of first solder bumps respectively to said  
solder bump pads formed on said semiconductor die;
- 15           (p)   establishing at least one unit substrate formed of a material  
substantially transparent to light within said predetermined  
range of wavelengths;
- (q)   applying at least a first metal layer on said unit substrate about a  
front surface region thereof;
- 20           (r)   selectively removing portions of said first metal layer to define a  
plurality of first and second solder bump pads and a plurality of  
interconnection lines each extending between at least one first  
solder bump pad and at least one said second solder bump pad;

- 5           (s)   forming at least one passivation layer to extend over said first metal layer;
- (t)   selectively removing portions of said passivation layer to define a plurality of first and second access openings aligned respectively with said first and second solder bump pads;
- 10           (u)   placing said semiconductor die in inverted manner over said unit substrate, said first solder bumps each engaging one said first access opening of said passivation layer to contact one said first solder bump pad, said photo-sensing area of said semiconductor die being thereby guided into alignment with said front surface
- 15                   region of said unit substrate; and,
- (v)   heating said first solder bumps to a characteristic reflow temperature thereof for attachment to said first solder bump pads of said unit substrate.
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5           23. The method of packaging a photo-sensing semiconductor device as  
recited in Claim 22 further comprising the step of attaching a plurality of second  
solder bumps respectively to said second solder bump pads through said second  
access openings.

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          24. The method of packaging a photo-sensing semiconductor device as  
recited in Claim 22 further comprising after step (h) the steps of applying a dust-  
sealing material over at least a portion of said passivation layer; and, selectively  
removing portions of said dust-sealing material to form a dust-seal layer about  
15   said front surface region of said unit substrate.

          25. The method of packaging a photo-sensing semiconductor device as  
recited in Claim 22 wherein a plurality of said unit substrates are integrally  
20   defined on a substrate, said substrate being diced after step (j) for separation of  
said unit substrates one from the other.

5           26. The method of packaging a photo-sensing semiconductor device as  
recited in Claim 22 wherein a plurality of said semiconductor dice are integrally  
defined on a wafer, said wafer being diced before step (i) for separation of said  
semiconductor dice one from the other.

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          27. The method of packaging a photo-sensing semiconductor device as  
recited in Claim 26 wherein a pick-and-flip-and-place operation is sequentially  
executed to place said semiconductor dice respectively over corresponding ones  
of said unit substrates.

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          28. The method of packaging a photo-sensing semiconductor device as  
recited in Claim 22 further comprising before steps (c) and (i) the steps of  
applying a solder flux material respectively to said solder bump pads of said  
20 semiconductor die and said first solder bump pads of said unit substrate.

5           29. The method of packaging a photo-sensing semiconductor device as  
recited in Claim 22 further comprising the step of forming a second metal layer at  
least partially on said passivation layer, said second metal layer being patterned to  
extend at least partially over said first and second access openings to contact said  
first and second solder bump pads.

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